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Governor

BLOSSOM A. PERETZ, ESQ.
Ratepayer Advocate
and Director

EX PARTE OR LATE FILED

January 30, 1997

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VIA OVERNIGHT COURIER

William A. Caton, Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Re: In the Matter of the Federal-State Joint Board on Universal Service
Staff Workshops on Proxy Cost Models
CC Docket No. 96-45; DA 97-88

Dear Secretary Caton:

Enclosed please find an original and five copies of the Revised Version of the Telecom Economic Cost Model developed by Ben Johnson Associates, Inc. and submitted by this office to the Federal-State Joint Board on Universal Service for consideration as the proxy cost model for determining the cost of providing the services supported by the universal service support mechanism. You will also find enclosed Comments of the New Jersey Division of the Ratepayer Advocate Concerning Improvements to the Telecom Economic Cost Model. The Telecom Economic Cost Model was initially submitted by this office to the Joint Board on January 7, 1997 and comments on the model were submitted by this office on January 24, 1997.

Please time/date stamp the copy marked "File" and return it to this office in the enclosed, self-addressed stamped envelope.

Respectfully submitted,
Blossom Peretz, Ratepayer Advocate

By: Jonathan Askin
Jonathan Askin, Esq.
Assistant Deputy Public Advocate

Enc.

cc: Federal-State Joint Board and Joint Board Staff (1 copy each)
Sheryl Todd (4 copies)
International Transcription Service, Inc. (1 copy)

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Federal-State Joint Board
On Universal Service Proxy Cost Models
CC Docket 96-45: DA 97-88

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BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of the Federal-State	)	
Joint Board on Universal Service	)	CC Docket No. 96-45
Staff Workshops on	)	
Proxy Cost Models	)	DA 97-88

Comments of the New Jersey Division of the Ratepayer Advocate Concerning Improvements to the Telecom Economic Cost Model

The New Jersey Division of the Ratepayer Advocate ("Ratepayer Advocate") files these further supplemental comments in support of the Telecom Economic Cost Model. The Ratepayer Advocate recommends that the Joint Board rely upon the Telecom Economic Cost Model for calculating the cost of providing the services to be supported through the new federal universal service support mechanism.

In the two weeks since the Telecom Economic Cost Model was submitted for consideration at the January 14 and 15 Proxy Cost Workshop, the model has been refined and improved in a number of ways in response to comments made by workshop participants.

The following materials accompany these comments:

(1) A diskette containing two files in compressed form. One is a revised and updated version of the model. The second is a revised and updated input data file for Southwestern Bell's Texas wire centers. The latter file differs from the data file accompanying the January 7, 1997 submission because it includes data concerning groundwater and soil conditions. The source of this data file is publicly available BCM2 output files. It should be noted that, to the extent more accurate data becomes available from another source (e.g. Southwestern Bell engineering records, outputs files from the new BCPM model) data within this file can be readily revised or updated, as appropriate.

(2) Two revised sections of the TECM *User Documentation*, and the corresponding revisions to the Table of Contents. The first section describes the "Financial and Technical Assumptions" used to operate the model. The documentation has been revised to incorporate changes to the user inputs. The other revised section is Appendix A,

consisting of "snapshots" of the model pages as they appear on screen. The "Financial" and "Technical" pages have been expanded and modified, incorporating the additional user inputs, and reflecting changes to some of the default input values. No other portions of the original documentation, as submitted on January 7, 1997, are significantly affected by the model revisions.

(3) Results of a new illustrative cost study for Southwestern Bell - Texas. Comparison of these results with those submitted on January 7, 1997 reveals various changes. Most of the differences between the two illustrative studies reflect changes to default values, and the introduction of additional inputs, associated with buried and underground cable installations. The effect of these changes is particularly dramatic in some of the smallest, least densely populated Texas wire centers.

Summary of Changes to the Model

Financial Assumptions: The following financial assumptions have been modified:

(1) In the *Loaded Labor Cost per Hour* section, new input cells have been introduced, which allow the user to specify the additional cost of special equipment associated with the following tasks: pole installation, plowing/trenching, trenching under, around or through man-made obstacles, and manhole installation. The cost of this equipment is incorporated into the model as an additional loading onto the hourly cost of the labor that is required to perform the activities in question.

(2) In the *Fiber Electronics* section, the user is given greater control over the materials cost of the facilities at each end of the fiber cable. The user can specify a fixed component (the cost of a minimum size configuration excluding any channel capacity) and a variable component. The latter component is controlled through multiple input cells, thereby providing the user with additional flexibility in accurately modeling the economies of scale associated with a specific system, or the full array of systems available from the various manufacturers.

(3) In the *Outside Plant Structures* section, the array of user inputs has been greatly expanded, to provide greater flexibility and accuracy.

- Underground hand/manhole investment is specified with both fixed and variable components. The latter component allows the user to model the increased cost associated with larger manholes, which become necessary as the number of cable pairs increases.
- Underground conduit investment is specified with both fixed (per foot) and variable (per cable pair per foot) components.
- The cost of replacement sod can be input on a per linear foot basis.

(4) In the *Switching Investment* section, the cell specifying a general percentage discount has

been deleted. Instead, the materials cost of the switch components are input on a net (discounted) basis. This simplifies the interface, and better enables the user to model situations in which certain types of switching equipment are discounted less heavily than others.

Technical Assumptions: The following technical assumptions have been modified:

(1) The user can now specify different utilization factors for feeder, feeder/distribution, and distribution cable. The middle category encompasses cable which may be classified as feeder, sub-feeder, or distribution, depending upon the characteristics of the specific wire center and the engineering practices of the carrier. The user can still specify different utilization factors for geographic zones 1 and 2. The model allows the user a limited opportunity to vary utilization factors for business and residence customers, to the extent zone 1 contains a different (e.g. higher) proportion of business customers than zone 2. Similarly, both the utilization factors and the annual cost factors can be varied for each individual wire center. This flexibility provides the user with some additional flexibility in modeling potential differences in utilization factors and capital costs between wire centers with high proportions of business customers and those containing low proportions of business customers.

(2) In the *Loop Network Technology* section the break point between copper and fiber in the feeder/ distribution network was previously dependent on two variables: minimum fiber loop length and loops per network segment. A third variable has now been introduced — maximum copper loop length. In a mixed technology study, where the maximum amount of fiber is deployed subject to the user specified constraints, this variable ensures that the remote terminal is placed close enough to the customer to ensure that the copper cable between the customer location and the remote terminal does not exceed the user specified limitation. Collectively, these three variables allow the user to model a mixture of fiber and copper cable in accordance with a wide array of potential economic criteria, including cost minimization subject to technical constraints, revenue maximization subject to cost constraints, and fiber maximization subject to both cost and technical constraints.

(3) Further refinements have been made in the *Customer Dispersion Factors* section. The user has been provided with greater control over the mathematical functions used by the model to reflect the tendency for business and residence customers to be clustered together (not evenly distributed throughout the geographic area served by the wire center).

(4) New input cells for *Fiber Electronics* have been introduced. These allow users to more precisely specify the amount of time required to design, engineer and install the electronic facilities associated with fiber cable.

(5) The three cells which previously allowed the user to control *Placement Efficiency and Difficulty* have been deleted and replaced with a much more extensive set of user inputs in a greatly expanded *Structures* section:

- Percent of structure type (aerial, underground, buried) can now be specified separately for feeder, feeder/distribution, and distribution segments. The user can specify these percentages using fixed components and a component that varies with the size of the wire center.
- The model can now include additional labor for the installation of pole where soil conditions (e.g. presence of rock) make pole installation either difficult or very difficult.
- For both underground and buried installations, the user may now specify a trenching depth of either 36 or 24 inches. Different depths can be specified for copper and fiber, differentiated between feeder, feeder/distribution, and distribution segments. This allows the user to reflect the economic factors which influence the depth decision (e.g. increased risk of cable cuts with shallow installations versus greater cost of deeper installations). The user may specify the labor required in minutes per running foot for either depth.
- The user may also specify the additional labor required by difficult or very difficult soil conditions, groundwater conditions, and the presence of man-made obstacles like concrete, asphalt, water lines and sewer lines.
- The portion of the installation affected by man-made obstacles can also be specified, both as a function of density and as a function of other factors.
- Engineering hours per mile, which will tend to be greater for underground than for buried, can also be specified, as can average manhole/handhole spacing in feet and the fixed and variable (per cable pair) labor costs of manhole/handhole installation.
- Finally, this page now provides the user with more detailed control over the time required for installation of conduit or ducts.

All the modifications and additions described above have the effect of increasing the level of detail reflected in the model, and they allow the user to produce studies with even greater precision than before. The model continues to offer a relatively high degree of user friendliness, transparency of input assumptions and breadth of application. It should be noted, however, that the additional user inputs and more detailed algorithms provided in this improved version of the model require some additional computational time. Depending upon the amount of available RAM, it may take as little as 5 seconds, or as much as 30 seconds, to produce cost estimates for an individual wire center.

Default Values: In response to criticisms and suggestions made by participants at the workshop, some of the investment default values have been modified, particularly with regard to trenching, buried cable placement, and fiber electronics. In addition, the default value for the economic life of switching has been reduced to 12 years, and some of the plant specific cost factors have been adjusted as well.

Impact on the SWB - Texas Results

Readers can compare the results of an illustrative study using this improved version of the model with those submitted by the Ratepayer Advocate on January 7, 1997. Some cost items have gone down, while others have risen. The most significant changes appear in the investment in buried cable installations; this has a particularly significant impact in very low density areas, where the additional costs are spread over a small number of loops.

Conclusion

It is noteworthy that within the space of two weeks Ben Johnson Associates ® was able to assimilate and respond to various criticisms and suggestions made at the workshops, to incorporate many of them into the model, and to run a new illustrative study using these new capabilities and default values. These accomplishments are a reflection of both the flexible structure and inherent adaptability of the model itself, and the capabilities of the firm that created the model. The speed with which these improvements have been developed demonstrates that if the FCC were to select this model, any additional improvements or modifications that may be required by the FCC can be implemented quickly, thereby allowing the FCC and the Joint Board to meet all of their statutory deadlines.

Even without these improvements, the Telecom Economic Cost Model offered several advantages over the competing models. It is more flexible, contains many useful features not offered by the other two models, and is more user friendly. It is capable of providing straightforward results covering a wide range of scenarios, reflecting differences in the customer characteristics, network configurations, market shares, and geographic scopes of multiple carriers serving each area. With the additional user inputs and other improvements incorporated in the version submitted with these comments, the Telecom Economic Cost Model is now capable of producing even more precise and reliable cost estimates for high cost areas.

Accordingly, the New Jersey Division of the Ratepayer Advocate respectfully requests that the Joint Board consider adopting the Telecom Economic Cost Model as the proxy cost model to calculate the cost of providing the services to be supported through the new universal service support mechanism.

Respectfully submitted,

Blossom A Peretz

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REPORT

Ben Johnson®
Associates, Inc

Telecom Economic Cost Model

Revised Version

REVISED USER DOCUMENTATION

Federal - State Joint Board on Universal Service

CC Docket 96-45

January 31, 1997

Contents

Getting Started

Overview

The Telecom Economic Cost Model estimates the economic cost of local telephone networks. A user can estimate the costs of unbundled network elements as well as the costs of major network services like local exchange and switched access.

A wide variety of economic costs can be estimated: Long Run Average Cost (LRAC), Total Service Long Run Incremental Cost (TSLRIC), Total Element Long Run Incremental Cost (TELRIC), Long Run Marginal Cost of a Service (LRMCS), and Long Run Marginal Cost of an Element (LRMCE).

The user can analyze and compare costs under both monopoly conditions and competitive conditions by specifying the percentage market share served by the modeled network—from 100% for an incumbent monopolist down to 5% or less for a minor competitive carrier. Since the model's planning horizon assumptions are long run and forward looking, almost complete variability is possible in the size and design of the cable plant serving the central office. However, the model is normally run with the loop length data of existing wire centers (a "scorched node" rather than "scorched earth" approach).

The model also allows the user to isolate and separately analyze the economic costs of serving several specific types of customers (e.g., single line and/or multi-line, business and/or residential) and of a wide variety of geographic areas.

The Telecom Economic Cost Model is an "open" model: the user can study all the algorithms used to develop the cost estimates; the user can also trace from each input to each output, or vice versa, by studying the formulas in each cell or by using the "auditing" function in Microsoft Excel.

Computer Requirements

The Telecom Economic Cost Model was developed for Microsoft Excel 7.0, running on a Windows 95 operating system, but it can operate with earlier versions of Excel and Windows. The minimum hardware requirements are a 486 computer with 16 megabytes of RAM. However, we recommend 32 megabytes of RAM for the processing speed to view most results within a few seconds after a wire center is selected or an assumption is changed.

Operating Instructions

To use the model, first locate its file containing the model. While the file name may vary, it will typically be something like BJTECM.xls. Also locate the file containing the loop database. While the file name may vary, it will typically be something like STATEdata.xls. Either of these files may be contained within a compacted file with a name like NAME.zip which must be "unzipped" using standard software such as WinZip or PKUnzip.

Open both the model file and the loop data file, using Excel. You may then be asked whether to "re-establish links." If the loop data file is available, answer *yes*, allowing the model to read the data file. If a loop data file is not available, answer *no*, allowing you to study a user-defined hypothetical wire center (see below).

License Agreement and Introduction

When the model opens, you will be presented with a License Agreement, which you should read carefully. If you need to engage in activities not authorized by the agreement, contact Ben Johnson Associates, Inc. at (904) 893-8600. If you reject the agreement, the model will automatically close. If you accept the license terms, you will be taken to an introductory page, *Intro*. To begin working with the model, click the "Control" button in the upper portion of the screen, using the left button of the mouse (or other pointing device). This will take you to the *Control* page, allow you to specify the type of economic cost to study, and give you access to the remainder of the model.

Control

The *Control* page allows you to specify the type of economic cost to be estimated, selecting from five categories: Long Run Average Cost (LRAC), Total Service Long Run Incremental Cost (TSLRIC), Total Element Long Run Incremental Cost (TELRIC), Long Run Marginal Cost of a Service (LRMCS), and Long Run Marginal Cost of an Element (LRMCE).

After selecting the appropriate economic cost category, push the "Establish Parameters and View Results" button. This takes you to a page where you can precisely define the type of economic costs to be studied, along with certain related parameters.

Changing Assumptions

You can modify numerous other input values and assumptions by pushing the "Financial Assumptions" and "Technical Assumptions" buttons that appear at the bottom of the *Control* page and at the top of various other pages. Pushing these buttons takes you to the pages containing the key assumptions used by the model, all of which can be easily verified or modified. The financial assumptions include income tax rates, debt/equity ratios and cost rates, economic lives, plant-specific expense ratios, and various unit investment amounts (e.g., labor rates per hour). The technical assumptions include facility utilization and sharing factors, average calling characteristics, technical characteristics of the network, cable splicing and placement times, and various other assumptions.

Studying Individual Wire Centers

While the Telecom Economic Cost Model can analyze costs for entire states or regions, it accomplishes this one wire center at a time. This reduces the minimum computer hardware required to run the model. It also allows you to study each wire center in full detail. For instance, you can modify key assumptions to better fit the characteristics of particular wire centers, if you need this higher level of precision for a particular study.

To operate the model, you must select a specific wire center for which the model will estimate costs. Three types of wire centers can be selected:

- A hypothetical wire center with typical characteristics, such as a rural area, a small town, an urban business area, or an urban residential area.
- An actual wire center with characteristics specified in a data file. If the required data file is not available, you can gather the data and

prepare the required file, or contact Ben Johnson Associates, Inc. (904) 893-8600.

- A hypothetical wire center with characteristics that are user-established. Selecting this choice and pushing the "Establish characteristics" button takes you to the *Hypothetical Wire Center* page. You can then define a wire center with appropriate characteristics for the study in question, by specifying the average loop length, number of households, and number of business loops within each of four geographic quadrants served by the wire center.

Studying Large Areas

If you want to study costs for an entire state or other large geographic area, you can do so by studying each of the wire centers within the specified area. As each wire center is studied in turn, you simply accumulate the resulting cost estimates, which you can then list, total, or average, as you choose.

Illustrative Pages

Appendix A contains illustrative excerpts from the model, replicating on-screen displays that you will see as you use the model.

Specifying the Type of Economic Cost

Types of Economic Cost

A key feature of the Telecom Economic Cost Model is its versatility in allowing users to compare and contrast a wide variety of different economic cost concepts. The model can develop five broad categories of long run economic cost estimates: Long-Run Average Cost (LRAC), Total Service Long-Run Incremental Cost (TSLRIC), Total Element Long Run Incremental Cost (TELRIC), Long-Run Marginal Cost of a Study (LRMCS), and Long Run Marginal Cost of an Element (LRMCE). Within each of these broad categories, a variety of different specific long-run cost estimates can be developed.

Average cost is the total cost of producing a given quantity of output, divided by the total number of units produced. In contrast, *marginal cost* is the rate of change in total cost resulting from changes in output. In a sense, average cost and marginal cost lie at two ends of a spectrum, with incremental cost ranging between these two extremes, depending upon the defined increment.

Incremental cost is the change in total cost resulting from a specified increase or decrease in output. In mathematical terms, incremental cost equals total cost assuming the increment is produced, minus total cost assuming the increment is not produced. Because a wide variety of different increments (changes in output) can be specified, incremental cost can be very similar to (or equal) average cost, or it can be very similar to marginal cost, depending upon the specific increment being studied.

Long Run Average Cost (LRAC)

Average costs can sometimes be useful in evaluating barriers to entry, and the likelihood that a new carrier will find it profitable to build a network to serve a particular geographic area. Unless the carrier anticipates generating total revenues in excess of its total costs, it is not likely to enter a market. In making this evaluation, a comparison of average revenues to average cost may be useful, particularly where market segmentation and/or price discrimination are not significant factors. Where they are significant in a market, however, an average cost analysis should be supplemented with a marginal cost analysis, or a precisely focused incremental cost analysis, in order to fully evaluate the prospects of the carrier recovering its total costs.

Similarly, if a new entrant's expected average costs is less than the average costs it would incur using the services or unbundled elements of another carrier, it may not choose to install its own network, unless the carrier places sufficient emphasis on the quality control and other benefits of controlling its own facilities. Thus, average cost calculations can be useful in evaluating the likelihood that facilities based entry will occur in a particular market.

To conduct a Long Run Average Cost study, select this option on the *Control* page, then push the "Establish Parameters and View Results" button. This takes you to the *LRAC* page. Here various choices allow you to precisely define the type of average economic cost you want to estimate. The options are outlined below.

Stand-Alone or Composite Costs

You must choose among single and/or multiline residence and/or business customers. If you select a narrow market category (e.g., residence customers only) the model will produce a "stand alone" cost study for this category of service. For instance, specifying residence customers only or business customers only will cause the model to build a network serving the locations specific to those customers and with facilities scaled to meet their needs alone.

By contrast, if you select both residence and business customers, the model will build a larger, more extensive network serving both residential and business locations and will thus estimate the average cost of serving both types of customers simultaneously. Economies of scope tend to make the latter figure lower than the stand-alone average cost of serving either category separately.

Direct, Joint and Common Costs

You must also decide whether to limit the study to direct costs or to include shared (joint and/or common) costs as well, specifying the amount.

Joint costs are a specific type of shared cost--one incurred when production processes yield two or more outputs in fixed proportions. Put another way, once joint costs are incurred to provide one product or service, they are costlessly available to provide one or more other products or services as well.

A classic example arises in the joint production of leather and beef. Although cattle feed is a necessary input for the production of both gloves and hamburgers, there is no economically meaningful way to separate out the feed costs that are required to produce each. If the quantity of leather and beef is reduced, there will be a savings in the amount of cattle feeding costs, but it is impossible to say how much of this change in cost results from the change in the quantity of leather and how much from the change in the quantity of beef.

The joint cost percentage you select is included in the study output. For a "pure" economic cost study, this would normally be set at 0% for a single service (e.g., local exchange). It would be set at 100% for the entire family of services engaged in the joint production process.

In general, *common costs* are incurred when production processes yield two or more outputs. They may be common to the firm's entire output or to just some parts of its output. An increase in production of any one good will tend to increase the level of common costs; however, the increase will not necessarily be proportional. The costs of producing several products within a single firm may be less than the sum of the analogous costs that would be incurred if each of the products were produced separately. The savings thus obtained are known as *economies of scope*.

The Telecom Economic Cost model does not analyze common costs in detail; it simply adds a user-specified allowance for them as a percentage of the direct and/or joint costs included in the study.

Network Size

Economies of scale and scope can cause average costs to vary widely with the size of the network. As telecom markets become more competitive, it becomes increasingly important to consider how a carrier's costs are related to its network's market share as well as to that network's geographic scope. The model will build a network sized to optimally serve whatever portion of the market you specify. Thus, for example, if you specify 100% market share, the model will build a network of optimal size to serve all of the (business and/or residence) customers in the specified geographic area; if you select a 25% market share, the model will build a smaller network, just large enough to serve one-fourth of the total market.

To provide for cost variation within individual wire centers, the model gives each wire center two geographic zones--zone 1 covering the highest density portions (assumed to be in the immediate vicinity of the wire center or end office switch) and zone 2 covering a much larger area, with greater loop lengths and a lower concentration of customers.

The LRAC cost estimates are displayed at the bottom of this page for the selected wire center. The total cost per line is shown, and the costs are disaggregated into functional categories. If you have chosen to include joint or common costs, these appear, as well.

Total Service Long Run Incremental Cost (TSLRIC)

Total service long run incremental cost is equal to the firm's total cost of producing all of its services assuming the service (or group of services) in question is offered, minus the firm's total cost of producing all of its services excluding the service (or group of services) in question. TSLRIC has also been defined as the change in total cost resulting from adding the entire amount of a service to the company's total output, with the output of all other services remaining constant. In effect, TSLRIC measures the difference between producing a service and not producing it.

TSLRIC can be useful in public policy and pricing decisions. For example, TSLRIC estimates can indicate the presence or absence of subsidies for a service in the aggregate. Similarly, incremental costs can be useful in developing or examining regulatory or pricing policies applicable to a particular service or group of customers. For instance, the Telecom Economic Cost model can compute the additional cost incurred when a network is expanded to serve a specified block of customers (e.g., all residential customers, or the most price-sensitive portion of the market, or the low-income customers eligible for a special program, etc.). Incremental cost is a key consideration in evaluating the price charged the specified block of customers.

To conduct a TSLRIC study, select this option on the *Control* page, then push the "Establish Parameters and View Results" button. This takes you to the *TSLRIC* page, where you may precisely define the type of incremental cost to estimate. A wide choice of cost studies is available.

Defining the Increment to be Studied

Since incremental cost is the change in total cost associated with a specified increase or decrease in output, it is fundamentally a comparison between two alternative scenarios (one with and one without the output increment). Accordingly, the model estimates TSLRIC by building two networks of different size and scope, then comparing the resulting costs.

You can specify whether the increment is added to or removed from the alternative network. This decision may affect the way you interpret or describe your study, but it generally doesn't affect the cost estimates in a long run context, where sunk costs are not involved, and all costs can vary. If you decide to proceed by adding the increment, the network will be modeled excluding the service in question in the first configuration and including it in the second. If you decide to proceed by removing the increment, the order of the configurations will be reversed. In either order, the model simultaneously calculates the costs associated with these two alternative networks, compares them, and computes the difference, which is equal to the TSLRIC of the specified increment.

For most purposes TSLRIC is usefully stated on a per unit basis. In fact, it is common practice to report and refer to TSLRIC per unit, without including the term "per unit." In the model, aggregate TSLRIC is computed for each wire center, and this aggregate amount is then divided by the change in output (incremental volume), resulting in TSLRIC per unit. It is